ENGINEERING AND TECHNOLOGY EDUCATION

Academic Standards for this area are available at
http://www.doe.in.gov/standards/standards2000_technology.html

Teacher Requirements for this area are available at
http://doe.in.gov/dps/licensing/assignmentcode

Middle School Course Titles and Descriptions

TECHNOLOGY

0490 *(TECH ML)*

Technology (& Engineering) Education at the middle level provides students with hands-on, problem based learning opportunities that introduce the principles to develop, produce, use, and assess products related to engineering and technology. Students additionally develop individual and teamwork skills to participate in society and the workplace. The curriculum is designed for 36 weeks. Instruction may be divided into two 18-week or three 12-week courses. Activities are focused on content related to engineering and technology as a body of knowledge, using resources and actions to: (1) apply engineering design (2) use processes to produce artifacts and systems, (3) use devices, tools and systems safely and appropriately (4) assess impacts on society and the environment. Students learn that *technology* is a *system* and that the four technological actions are universal to all technologies. Activities develop the students' abilities to:

1. *Describe the structure and impact of engineering and technology in communication, construction, manufacturing, and transportation technologies.*
2. *Understand how engineering and technology is a system comprised of inputs, processes, outputs, feedback, goals, and impacts.*
3. *Apply technical processes and materials to manufacture products and construct structures.*
4. *Use a variety of technical means to design, produce, analyze, and deliver messages.*
5. *Design and construct models of energy, power & transportation systems and devices.*

- Recommended Grade Levels: Grades 7 and 8, or Grades 6, 7, and 8
- Recommended Prerequisite: None
- An introductory middle level course to prepare students to help prepare students to pursue future courses in the area of Engineering & Technology

NOTE: Appropriately licensed teachers may also teach the following PLTW and/or Trade and Industrial Education courses within Engineering and Technology Education such as: Advanced Manufacturing, Aerospace Engineering, Biotechnology, Civil Engineering and Architecture, Computer Integrated Manufacturing, Digital Electronics Engineering or Digital Electronics, Engineering Design and Development or Engineering, Gateway to Technology, Introduction to Engineering Design, and Principles of Engineering. Course titles and descriptions are listed within the PLTW or Trade and Industrial Education subject areas.

COMMUNICATION PROCESSES

4790 *(COMM PROC)*

Communication Processes is a course that specializes in using modern communication processes to exchange messages and information at greater volumes and improved speeds. This course explores the various technical processes used to link ideas and peoples through the uses of electronic and graphic media. Major goals of this course include an overview of communication technology; the way it has evolved, how messages are designed and produced, and how people may profit from creating information services and products. Students will explore mass media communication processes including radio and television broadcasting, publishing and printing activities, telecommunication networks, recording services, computer and data processing networks, and other related systems.

- Recommended Grade Levels: 10-11
- Recommended Prerequisites: Technology (ML), Technology Systems, Communication Systems
- Credits: 1 or 2 semester course, 1 credit per semester
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- A Career Academic Sequence, Career-Technical program, or Flex Credit course.
- Career Clusters: This course may be included as a component for career pathways in the Arts, A/V Technology & Communications Career Cluster

COMMUNICATION SYSTEMS

4780 *(COMM SYST)*

Communication Systems is a course that specializes in how people use modern communication systems to exchange information and ideas. These systems allow people to grow intellectually, express feelings, and better understand diverse cultures. This course explores the application of the tools, materials, and techniques used to design, produce, use, and asses systems of communication. Instructional strategies introduce students to the world of communication technology through a variety of means including: presentations, discussions, and laboratory activities. Students will produce graphic and electronic media as they apply communication technologies. Most activities are designed for small group work since communication takes place between two parties or machines.

- Recommended Grade Levels: 9-10
- Recommended Prerequisite: Technology (ML), Technology Systems
- Credits: 1 or 2 semester course, 1 credit per semester

- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- A Career Academic Sequence, Career-Technical program, or Flex Credit course.
- Career Clusters: This course may be included as a component for career pathways in the Arts, A/V Technology & Communications Career Cluster

COMPUTERS IN DESIGN AND PRODUCTION SYSTEMS

4800 *(COMP DES)*

Computers in Design and Production Systems is a course that specializes in using modern technological processes, computers, design, and production systems in the production of products and structures through the use of automated production systems. Emphasis is placed on using modern technologies and on developing career related skills. The content and activities should be developed locally in accordance with available advanced technologies in the school. Course content should address major technological content related to topics such as: design documentation using CAD systems; assignments involving the interface of CAD, CAM, and CIM technologies; computer simulation of products and systems; animation and related multimedia applications; control technologies; and automation in the modern workplace.

- Recommended Grade Levels: 10-11
- Recommended Prerequisite: Technology (ML)
- Credits: 1 or 2 semester course, 1 credit per semester
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- A Career Academic Sequence, Career-Technical program, or Flex Credit course.
- Career Clusters: This course may be included as a component for career pathways in the Architecture & Construction, Arts, A/V Technology & Communications, Manufacturing, Science, Technology, Engineering & Mathematics and Transportation, Distribution, & Logistics career cluster

CONSTRUCTION PROCESSES

4792 *(CONS PROC)*

Construction Processes is a course that specializes in using modern technological processes to produce structures on a site. Structures may include residential, commercial, institutional, and industrial buildings. Additional structures may include special purpose facilities built for displays, sports contests, and transportation terminals. Students will study construction technology topics such as preparing a site, doing earthwork, setting footings and foundations, building the superstructure, enclosing the structure, installing systems, finishing the structure, and completing the site. Students may also investigate topics related to the purchasing and maintenance of structures.

- Recommended Grade Levels: 10-11
- Recommended Prerequisites: Technology (ML), Construction Systems
- Credits: 1 or 2 semester course, 1 credit per semester
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- A Career Academic Sequence, Career-Technical program, or Flex Credit course.
- Career Clusters: This course may be included as a component for career pathways in the Architecture & Construction Career Cluster

CONSTRUCTION SYSTEMS

4782 *(CONS SYST)*

Construction Systems is a course that specializes in how people use modern construction systems and the management of resources to efficiently produce a structure on a site. Students will explore the application of tools, materials, and energy in designing, producing, using, and assessing the construction of structures. Classroom activities introduce students to the techniques used in applying construction technology to the production of residential, commercial, and industrial buildings in addition to civil structures. Students learn how architectural ideas are converted into projects and how projects are managed during a construction project in this course.

- Recommended Grade Levels: 9-10
- Recommended Prerequisite: Technology (ML)
- Credits: 1 or 2 semester course, 1 credit per semester
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- A Career Academic Sequence, Career-Technical program, or Flex Credit course.
- Career Clusters: This course may be included as a component for career pathways in the Architecture & Construction Career Cluster

DESIGN PROCESSES

4794 *(DES PROC)*

Design Processes is a course that specializes in modern design and engineering processes with a focus on creative problem solving in developing, engineering, testing, and communicating designs for products, structures, and systems. Classroom activities help students to understand the steps used to move an idea from a designer's mind into an engineered artifact, process, or system. Students will participate in design activities using critical thinking skills that require them to: identify problems; generate alternative solutions; select and refine the most plausible solution; develop specifications for the solution; model and test the solution; and present the final solution for approval.

- Recommended Grade Levels: 10-11
- Recommended Prerequisite: Technology (ML), Computers in Production & Design Systems
- Credits: 1 or 2 semester course, 1 credit per semester
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- A Career Academic Sequence, Career-Technical program, or Flex Credit course.
- Career Clusters: This course may be included as a component for career pathways in the Architecture & Construction, Arts, A/V Technology & Communications, Manufacturing, Science, Technology, Engineering & Mathematics and Transportation, Distribution, & Logistics career cluster

DESIGN TECHNOLOGY HIGHER LEVEL, INTERNATIONAL BACCALAUREATE

4822 *(DTECH H IB)*

Design Technology Higher Level, International Baccalaureate aims to teach students not only design and technology, but also how to adapt to new experiences and how to approach problems with the appropriate skills and techniques to identify important elements and develop optimum solutions. It assumes no previous experience in either design technology or designing. Students study six core topics: designers and the design cycle, the responsibility of the designer, materials, manufacturing processes and techniques, production systems, and clean technology and green design. Students must complete additional study in three topics: raw material to final product, microstructures and macrostructures, and appropriate technologies. Optional course topics from which the student may choose two from include: food technology, computer-aided design, manufacture and production, invention, innovation and design, health by design, and electronic products.

- Recommended Grade Level: Grades 11 and 12
- Recommended Prerequisite: Technology (ML), Technology Systems, Computers in Production & Design Systems or PLTW Introduction to Engineering Design, PLTW Principles of Engineering
- Credits: 4 semester course, 1 credit per semester
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors, Core 40 with Technical Honors and International Baccalaureate diplomas
- Academic content standards at http://www.ibo.org/
- A Career Academic Sequence, Career-Technical program or Flex Credit course
- Career Clusters: This course may be included as a component for career pathways in the Science, Technology, Engineering & Mathematics career cluster

DESIGN TECHNOLOGY STANDARD LEVEL, INTERNATIONAL BACCALAUREATE

4824 *(DTECH S IB)*

Design Technology Standard Level, International Baccalaureate aims to teach students not only design and technology, but also how to adapt to new experiences and how to approach problems with the appropriate skills and techniques to identify important elements and develop optimum solutions. It assumes no previous experience in either design technology or designing. Students study six core topics: designers and the design cycle, the responsibility of the designer, materials, manufacturing processes and techniques, production systems, and clean technology and green design. Optional course topics from which the student may choose two from include: food technology, computer-aided design, manufacture and production, invention, innovation and design, health by design, and electronic products. Further options include raw material to final product, microstructures and macrostructures, and appropriate technologies.

- Recommended Grade Level: Grades 11 or 12
- Recommended Prerequisite: Technology (ML), Technology Systems, Computers in Production & Design Systems or PLTW Introduction to Engineering Design, PLTW Principles of Engineering, PLTW Digital Electronics
- Credits: 2 semester course, 1 credit per semester
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors, Core 40 with Technical Honors and International Baccalaureate diplomas
- Academic content standards at http://www.ibo.org/
- A Career Academic Sequence, Career-Technical program or Flex Credit course
- Career Clusters: This course may be included as a component for career pathways in the Science, Technology, Engineering & Mathematics career cluster

FUNDAMENTALS OF ENGINEERING

4802 *(FUND ENG)*

Fundamentals of Engineering is a course that focuses on the process of applying engineering, technological, scientific and mathematical principles in the design, production, and operation of products, structures, and systems. An engineer is a highly educated and trained problem solver who engages in the functions of research, development, planning, design, production, and project management. Engineers often work as part of a team to plan, design, and supervise a product from concept to completion. This is a hands-on course designed to provide students interested in engineering careers to explore experiences related to specialized fields such as civil, mechanical, and materials engineering, etc. The topics of ethics and the impacts of engineering decisions are also addressed. Classroom activities are organized to allow students to work in teams and use modern technological processes, computers, CAD software, and production systems in developing and presenting solutions to engineering problems.

- Recommended Grade Levels: 11-12
- Recommended Prerequisite: Technology (ML), Computers in Design and Production Systems, Design Processes
- Credits: 1 or 2 semester course, 1 credit per semester
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- A Career Academic Sequence, Career-Technical program, or Flex Credit course.
- Career Clusters: This course may be included as a component for career pathways in the Science, Technology, Engineering & Mathematics career cluster

MANUFACTURING PROCESSES

4796 *(MFTG PROC)*

Manufacturing Processes is a course that specializes in using modern manufacturing processes to obtain resources and change them into industrial materials, industrial products and consumer products. Activities provide an understanding of the characteristics and properties of industrial materials and the processing of these materials into consumer goods. Students will investigate the properties of engineered materials such as: metallics; polymers; ceramics; and composites. After gaining a working knowledge of these materials, students will study six major types of material processes: casting and molding; forming; separating; conditioning; finishing; and assembling. In this course, each of these processes is a major body of content. It is through the study of common principles, supported by related laboratory and problem solving activities, that understanding is developed and reinforced.

- Recommended Grade Levels: 10-11
- Recommended Prerequisites: Technology (ML), Manufacturing Systems
- Credits: 1 or 2 semester course, 1 credit per semester
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- A Career Academic Sequence, Career-Technical program, or Flex Credit course.
- Career Clusters: This course may be included as a component for career pathways in the Manufacturing career cluster

MANUFACTURING SYSTEMS

4784 *(MFTG SYST)*

Manufacturing Systems is a course that specializes in how people use modern manufacturing systems with an introduction to manufacturing technology and its relationship to society, individuals, and the environment. An understanding of manufacturing provides a background toward developing engineering & technological literacy. This understanding is developed through the study of the two major technologies, material processing and management technology, used by all manufacturing enterprises. Activities allow students to study techniques used in identifying and obtaining resources in addition to developing an understanding of the primary and secondary processes used to convert raw materials into finished products.

- Recommended Grade Levels: 9-10
- Recommended Prerequisite: Technology (ML)
- Credits: 1 or 2 semester course, 1 credit per semester
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- A Career Academic Sequence, Career-Technical program, or Flex Credit course.
- Career Clusters: This course may be included as a component for career pathways in the Manufacturing career cluster

TECHNOLOGY AND SOCIETY

4804 *(TECH SOC)*

Technology and Society is a course that specializes in the study of technology as a pervasive, complex force that is interwoven in the cultural, social, political, ethical and intellectual existence of all people. The development of technology has brought about new dangers related to material and social wealth. This is leading to a growing awareness of the direct and indirect consequences of our technological world, and the need to develop alternative means of accomplishing societal goals. As technologies become more powerful and integrated across societies, the ability to foresee the social, economic, and environmental consequences of their development has become increasingly critical. The goal of this course is to increase student awareness of the uncertainties and future direction associated with technological development. Emphasis is given to the nature of technology, the impact of devices and systems on the quality of life, assessment of the benefits and risks of technology, and technological ethics for responsible decision-making.

- Recommended Grade Levels: 11-12
- Recommended Prerequisite: Technology (ML), Technology Systems
- Credits: 1 semester, 1 credit per semester
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- A Career Academic Sequence, Career-Technical program, or Flex Credit course.

TECHNOLOGY ENTERPRISES

4806 *(TECH ENTER)*

Technology Enterprises is an application course that allows students to apply technological, engineering, and managerial principles in organizing, financing, and operating a company to produce a product, structure, or service. Students learn through this course how enterprises are

developed and operated in an efficient manner. The key focus of this course is to allow students to structure and operate a real-life enterprise within the classroom environment. Students learn about the kinds of productive enterprises; principles of management; how to develop products and services; how to organize an enterprise; how to operate an enterprise; the delivery of products or services; the marketing of products or services and the closing of an enterprise.

- Recommended Grade Levels: 11-12
- Recommended Prerequisite: Technology (ML), Manufacturing Systems, Manufacturing Processes
- Credits: 1 or 2 semester course, 1 credit per semester
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- A Career Academic Sequence, Career-Technical program, or Flex Credit course.
- Career Clusters: This course may be included as a component for career pathways in the Manufacturing career cluster

TECHNOLOGY SYSTEMS

4808 *(TECH SYST)*

Technology Systems is a course that focuses on the technologies used in the career pathways related to Architecture & Construction, Arts, A/V Technology & Communications, Manufacturing, Science, Technology, Engineering & Mathematics and the Transportation, Distribution, & Logistics career clusters. Instructional strategies include creative problem solving activities that address real-world problems and opportunities. Computer experiences are used to incorporate graphics, simulations, networking, and control systems. Students are also introduced to, and engaged in, investigating career opportunities within a career cluster of their choice. Systems thinking skills are used by students to study, diagram, and test a solution to a scenario related to their career interests.

- Recommended Grade Levels: 9-10
- Recommended Prerequisite: Technology (ML)
- Credits: 1 or 2 semester course, 1 credit per semester
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- A Career Academic Sequence, Career-Technical program, or Flex Credit course.
- Career Clusters: This course may be included as a component for career pathways in several career clusters

TRANSPORTATION PROCESSES

4798 *(TRANS PROC)*

Transportation Processes is a course that specializes in the study of the transportation processes and the logistics of moving people, cargo and goods from one location to another. Transportation is a managed system that uses inputs, processes, and outputs to move people, cargo and goods. Content of this course includes the study of how transportation impacts individuals, society, and the environment and how these processes require continual assessment/feedback to control the system. This course focuses on the environments in which transportation occurs: land, air, water, and space and the logistical processes for receiving, storing, routing, loading, transporting, unloading, storing and delivering of people, cargo and goods.

- Recommended Grade Levels: 10-11
- Recommended Prerequisites: Technology (ML), Transportation Systems
- Credits: 1 or 2 semester course, 1 credit per semester
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- A Career Academic Sequence, Career-Technical program, or Flex Credit course.
- Career Clusters: This course may be included as a component for career pathways in the Transportation, Distribution, & Logistics career cluster

TRANSPORTATION SYSTEMS

4786 *(TRANS SYST)*

Transportation Systems is a course that specializes in the study of the transportation systems used to support commerce and the logistics for the efficient movement of goods and people. In this course, students will explore the systems, techniques and vehicles used to move people and cargo on land, water, air, and space. Activities allow students to understand a variety of transportation systems and investigate the energy, power and mechanical systems used to move people and products from one location to another.

- Recommended Grade Levels: 9-10
- Recommended Prerequisites: Technology (ML)
- Credits: 1 or 2 semester course, 1 credit per semester
- Credits: A one credit course offered over one semester.
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- A Career Academic Sequence, Career-Technical program, or Flex Credit course.
- Career Clusters: This course may be included as a component for career pathways in the Transportation, Distribution, & Logistics career cluster